

Multilayer-coated EUV telescopes for the Atmospheric Imaging Assembly instrument aboard NASA's Solar Dynamics Observatory

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The Atmospheric Imaging Assembly (AIA) instrument aboard NASA's Solar Dynamics Observatory (SDO) mission, scheduled for launch in 2008, is designed to provide an unprecedented view of the solar corona, taking images that span at least 1.3 solar diameters in multiple wavelengths nearly simultaneously, at a resolution of 1 arcsecond, field of view exceeding 41 arcminutes and at a cadence of 10 seconds or better. AIA will produce essential data for quantitative studies of the evolving coronal magnetic field and its plasma. These data will be used to significantly improve the understanding of the physics behind the activity displayed by the Sun's atmosphere, which drives space weather in the heliosphere and in planetary environments. The AIA is composed of four telescopes, each including a primary-secondary pair of mirrors operating at near-normal angles of incidence. Each telescope produces images at two different wavelengths, which is accomplished by two different multilayer coatings acting as Bragg reflectors, deposited across two respective D-shaped areas on each mirror. In this manner, imaging at a total of eight channels -seven in the EUV and one in the UV range- is achieved. In this talk we are introducing the SDO/AIA mission and discussing the development of multilayer coatings for the seven EUV channels of the AIA instrument.

Multilayer film parameters for each EUV channel, spanning the range from 94 to 335 Angstroms, have been uniquely optimized to satisfy criteria for peak reflectivity (throughput), suppression of nearby emission lines, lifetime stability and stress properties. Another crucial requirement for efficient AIA imaging is meeting the wavelength specifications across each multilayer-coated flight optic pair, which in turn depends on precise thickness control of the multilayer thin film across each curved mirror surface. Experimental results on all aforementioned aspects of the EUV multilayer optics for AIA will be presented, including EUV reflectance measurements performed at beamline 6.3.2 of the ALS.